National Institute of Environmental Health Sciences

NASA A-Train and Terra observations of the 2010 Russian wildfires

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Abstract:

Wildfires raged throughout western Russia and parts of Eastern Europe during a persistent heat wave in the summer of 2010. Anomalously high surface temperatures (35-41 °C) and low relative humidity (9-25 %) from mid-June to mid-August 2010 shown by analysis of radiosonde data from multiple sites in western Russia were ideal conditions for the wildfires to thrive. Measurements of outgoing longwave radiation (OLR) from the Atmospheric Infrared Sounder (AIRS) over western Russian indicate persistent subsidence during the heat wave. Daily three-day back-trajectories initiated over Moscow reveal a persistent anti-cyclonic circulation for 18 days in August, coincident with the most intense period of fire activity observed by Moderate Resolution Imaging Spectroradiometer (MODIS). This unfortunate meteorological coincidence allowed transport of polluted air from the region of intense fires to Moscow and the surrounding area. We demonstrate that the 2010 Russian wildfires are unique in the record of observations obtained by remote-sensing instruments on-board NASA satellites: Aura and Aqua (part of the A-Train Constellation) and Terra. Analysis of the distribution of MODIS fire products and aerosol optical thickness (AOT), UV aerosol index (AI) and single-scattering albedo (SSA) from Aura's Ozone Monitoring Instrument (OMI), and total column carbon monoxide (CO) from Aqua's Atmospheric Infrared Sounder (AIRS) show that the region in the center of western Russia surrounding Moscow (52°-58° N, 33°-43° E) is most severely impacted by wildfire emissions. Over this area, AIRS CO, OMI AI, and MODIS AOT are significantly enhanced relative to the historical satellite record during the first 18 days in August when the anti-cyclonic circulation persisted. By mid-August, the anti-cyclonic circulation was replaced with westerly transport over Moscow and vicinity. The heat wave ended as anomalies of surface temperature and relative humidity, and OLR disappeared. After 18 August the fire activity greatly diminished over western Russia and levels of the satellite smoke tracers returned to values typical of previous years. © Author(s) 2011.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Extreme Weather Event, Meteorological Factors, Temperature

Air Pollution: Interaction with Temperature, Particulate Matter, Other Air Pollution

Air Pollution (other): CO

Extreme Weather Event: Wildfires

Geographic Feature: ☑

resource focuses on specific type of geography

Urban

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Russia

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Mitigation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Computing System, Exposure Change Prediction, Methodology

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified